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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/967,184	09/28/2001	Heikki Heikkila	14766	5971
7590 06/02/2004				
SCULLY, SCOTT, MURPHY & PRESSER 400 Garden City Plaza Garden City, NY 11530		EXAMINER MCINTOSH III, TRAVISS C		
		ART UNIT PAPER NUMBER		
		1623		

DATE MAILED: 06/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/967,184	<b>Applicant(s)</b> HEIKKILA ET AL.	
	<b>Examiner</b> Traviss C McIntosh	<b>Art Unit</b> 1623	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 24 February 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-49 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

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### **DETAILED ACTION**

The Amendment filed February 24, 2004 has been received, entered into the record, and carefully considered. The following information provided in the amendment affects the instant application by:

Claims 1-2, 5, 7-8, 10, 19-26, and 43-45 have been amended.

Remarks drawn to rejections of Office Action mailed October 21, 2003 include:

112 2<sup>nd</sup> paragraph rejections: which have been overcome by applicant's amendments and arguments and have been withdrawn.

102(a) rejection: which has been maintained for reasons of record.

103(a) rejection: which has been maintained for reasons of record.

An action on the merits of claims 1-49 is contained herein below. The text of those sections of Title 35, US Code which are not included in this action can be found in a prior Office action.

#### ***Claim Rejections - 35 USC § 102***

The rejection of claims 1, 12-14, 16, 27-31 and 42 under 35 U.S.C. 102(a) as being anticipated by Heikkila et al. (US Patent 5,998,607) is maintained for reasons of record.

Claim 1 of the instant application is drawn to a multistep process for recovering rhamnose, arabinose, xylose, or mixtures thereof from a solution containing at least 2 of said monosaccharides wherein a weak acid cation exchange resin is used for at least one step of chromatographic separation. Claim 12 provides the weak acid cation exchange resin is an acrylic

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resin and claim 13 provides various forms of acrylic resins. Claim 14 limits the cation of the resin to be  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{H}^+$ , or  $\text{Ca}^{2+}$ . Claim 16 provides the resin is cross-linked with DVB. Claim 27 provides the temperature of the eluate is 10-95°C and claim 28 limits that to 55-85°C. Claim 29 limits the particle size of the resin to 10-2000µm and claim 30 limits the size to 100-400µm. Claim 31 limits the pH of the feed solution to 1-10. Claim 42 provides that the method is a batch process.

Heikkila et al. disclose a method of separating xylose from a Mg-sulphite cooking liquor (see example 11, column 9). The xylose is separated from the Mg-sulphite cooking liquor (which is known in the art to contain multiple monosaccharides, including xylose, arabinose, and rhamnose) using a slightly acid cation exchange resin, Purolite C 105™. This resin is known to be a weak acid cation exchange resin (see technical data sheet for product) with a polymer matrix structure of acrylic-divinylbenzene and the resin is shown to be in the  $\text{H}^+$  form. Moreover, the particle size of the resin is shown to be 1.2 mm to 0.3 mm (1200 to 300 µm). Heikkila et al. teach the temperature to be 65°C and the pH of the feed solution to be 4.5. Additionally, the process of Heikkila et al. is seen to be a batch process.

The methods of claims 1, 12-14, 16, 27-31 and 42 are seen to be anticipated by Heikkila et al. (US Patent 5,998,607).

Applicant's arguments filed February 24, 2004 have been fully considered but they are not persuasive. Applicants argue that the instant application is drawn to recovering one or more monosaccharides, not a solution of multiple monosaccharides and Heikkila et al. does not teach or suggest the use of a weak cation exchange resin for the recovery of monosaccharides from

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each other. Applicants further argue that Heikkila et al. is silent to the separation and/or identification of other sugars, such as rhamnose and arabinose.

However, independent claim 1 of the instant application is drawn to a multistep process for recovering one or more monosaccharides from a feed solution containing at least two monosaccharides by using chromatographic separation comprising at least one step where a weak acid cation exchange resin is used for the chromatographic separation. Heikkila et al. disclose a method wherein a weak acid cation exchange resin is used in at least one step wherein a xylose fraction is recovered (see step b in claim 10; “and a fraction concentrated with respect to xylose is recovered”). Moreover, as set forth earlier, the Mg-sulphite cooking liquor is known in the art to contain multiple monosaccharides, including xylose, arabinose, and rhamnose. Thus, Heikkila et al. do indeed disclose a multistep process for recovering one or more monosaccharides (xylose) from a feed solution containing at least two monosaccharides by using chromatographic separation comprising at least one step where a weak acid cation exchange resin is used for the chromatographic separation

### ***Claim Rejections - 35 USC § 103***

The rejection of claims 1-6 and 8-49 under 35 U.S.C. 103(a) as being unpatentable over Heikkila et al. (US Patent 5,998,607) in combination with Blaschek et al. (“Complete Separation and Quantification of Neutral Sugars from Plant Cell Walls and Mucilages by High-Performance Liquid Chromatography”, Journal of Chromatography, 256 (1983), pp. 157-163) is maintained for reasons of record. Moreover, claim 7 is additionally rejected over the same references, as the

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examiner was previously unclear of the meanings in the claim as indicated by the previously set forth 112 2<sup>nd</sup> paragraph rejections.

Claim 1 of the instant application is drawn to a multistep process for recovering rhamnose, arabinose, xylose, or mixtures thereof from a solution containing at least 2 of said monosaccharides wherein a weak acid cation exchange resin is used for at least one step of chromatographic separation. Claim 2 provides the limitation of eluting the column and separating and recovering a rhamnose rich fraction. Claim 3 provides that a strong acid cation exchange resin is additionally used. Claim 4 provides that an additional step in the process may be crystallization, filtration, evaporation, precipitation, or ion exchange. Claim 5 limits the monosaccharide recovered to rhamnose and claim 6 limits the rhamnose to L-rhamnose and claim 40 limits the form of rhamnose to the monohydrate form. Claim 7 provides that the source of the feed solution is a xylose process stream or side stream. Claim 8 and 10 provide that arabinose rich fraction and xylose rich fraction are further separated and recovered, and claims 9 and 11 limits the arabinose and xylose to L-arabinose and D-xylose. Claim 12 provides the weak acid cation exchange resin is an acrylic resin and claim 13 provides various forms of acrylic resins. Claim 14 and 15 provide limitations to the cation of the resin. Claim 16 provides the resin is cross-linked with DVB and claim 17 provides the crosslinking is 3-8% by weight. Claims 19-24 provide various orders of multiple and various chromatographic separations and claims 34, 35, 37, and 38 provide various orders of recovery of the products. Claims 25 and 26 provide that fractions of eluant are concentrated by evaporation before feeding to the next column. Claim 27 provides the temperature of the eluate is 10-95°C and claim 28 limits that to 55-85°C. Claim 29 limits the particle size of the resin to 10-2000µm and claim 30 limits the size to 100-400µm.

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Claims 31-33 limit the pH of the feed solution to be from 1-10. Claims 36, 39, and 41 provide that the products are isolated by crystallization. Claim 42 provides that the method is a batch process. Claims 43 and 44 provide the rhamnose can be collected before or after the other monosaccharides. Claim 45 provides that the rhamnose and arabinose are collected together. Claim 46 provides the separation method to be a simulated moving bed system, and claims 47 and 48 provide the moving bed system is either sequential or continuous. Claim 49 provides that there is at least one column or portion of a column which contains a strong acid cation exchange resin and another which contains a weak acid cation exchange resin.

Heikkila et al. disclose methods of separating xylose by using a slightly acidic cation exchange resin (example 11) as set forth supra. What is not taught by Heikkila et al. is to use multiple columns, the order of the various monosaccharides (rhamnose, xylose and arabinose) which are eluted, to use water as the eluant, to use the resin in the  $\text{Na}^+$  form, to concentrate the solution before transferring to the next column, to isolate the products by crystallization, or to use the various simulated moving bed systems.

Blaschek et al. teach of methods of separating L-rhamnose, L-arabinose, D-xylose, D-mannose, D-galactose, and D-glucose by multiple chromatography runs using water as the eluant. Blaschek et al. teach that the various sugars are eluted from columns at different rates, and are eluted from different columns at different rates (see Table 1). Blaschek et al. show that an initial run will separate rhamnose from xylose and arabinose, and then an additional run on a different column will separate xylose and arabinose. Thus Blaschek et al. do indeed recognize that one run on one column is not sufficient to separate various monosaccharides from each other.

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It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the weak acid cation exchange resin of Heikkila et al. to separate the various sugars, as Heikkila et al. teach the Purolite C 105™ column (which is a weak acid cation exchange resin) to be effective in separating a xylose containing fraction from a Mg-sulphite cooking liquor and one would have been motivated to use this column as it is known to be effective in sugar separation and multiple columns are shown to be effective when separating multiple sugars. Additionally, one would expect that methods would be correlative regardless of where the feed solution is obtained. That is, one of skill in the art would expect a solution which contains 3 agents to be separated by the same methods regardless of where the solution of the three agents are obtained, as the solution being separated still comprises the same three agents. Moreover, it would require little more than routine skill in the art to design a chromatographic separation process comprising multiple columns and determining the elution times of the various saccharides in a solution and develop a multiple column system which optimizes the elution time/product/column type relationship to obtain a system which is able to separate the various saccharides. One of ordinary skill in the art would understand that different products are eluted from columns at various rates as divergent products are known in the art to be obtained at various pHs in chromatography columns because of their different properties and reactivity kinetics. One of ordinary skill in the art would recognize that the various products would be eluted at various rates in a chromatographic column based on both the properties of the column and compound eluted. It would be obvious to one of ordinary skill in the art at the time the invention was made to add an additional chromatographic column which has different properties than the first column to purify a solution which has multiple compounds that would react differently to different



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columns and be eluted at different rates among the various columns. One would be motivated to have a multi column system and or a column with various zones which have different properties, such as ionic strength, to separate various compounds which are in the same solution as the products would be eluted at rates dependent upon the column/compound properties. One would be motivated to add the weak-acid cation exchange resin column of Heikkila et al. as Heikkila et al. teach that this column is effective in removing xylose from a solution which inherently has multiple compounds.

Applicant's arguments filed February 24, 2004 have been fully considered but they are not persuasive. The thrust of applicant's arguments are that the present invention is drawn to separating various monosaccharides from each other in one run on one column, and that a weak acid cation exchange resin could advantageously be used in a method for the chromatographic separation. However, claim 19 for example is drawn to a method which comprises "feeding the feed solution to a first chromatographic column and then feeding a fraction of the outcoming solution from the first chromatographic column to a second chromatographic column...". Claim 20 then provides "feeding a fraction from the second column to a third column". Thus, the examiner is confused by applicant's arguments that the claims are drawn to separating various monosaccharides from each other in one run in one column, as the claims are indeed drawn to multiple runs with multiple columns.

Additionally, applicants argue that the prior art does not teach that effecting the pH has an effect on the elution of the sugars. However, Heikkila et al. teach to adjust the pH of fractions, and that adjusting the pH indeed effects the order of elution (see column 3, lines 21-34). Thus, a weak acid cation exchange resin is known to be used in at least one step in separating

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monosaccharides, including xylose, in chromatographic separation. Moreover, multiple columns are shown to be effective when separating multiple sugars, as evidenced by Blaschek et al.

One of ordinary skill in the art would understand that different products are eluted from columns at various rates as divergent products are known in the art to be obtained at various pHs in chromatography columns because of their different properties and reactivity kinetics. One of ordinary skill in the art would recognize that the various products would be eluted at various rates in a chromatographic column based on both the properties of the column and compound eluted. It would be obvious to one of ordinary skill in the art at the time the invention was made to add an additional chromatographic column which has different properties than the first column to purify a solution which has multiple compounds that would react differently to different columns and be eluted at different rates among the various columns. Thus, it would require one of ordinary skill in the art routine experimentation to design a chromatographic separation process comprising multiple columns and determining the elution times of the various saccharides in a solution and develop a multiple column system which optimizes the elution time/product/column type relationship to obtain a system which is able to separate the various saccharides based on the art known resins utilized in monosaccharide separation, such as the weak acid cation exchange resin as taught by Heikkila et al. and the various resins taught by Blaschek et al.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

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***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

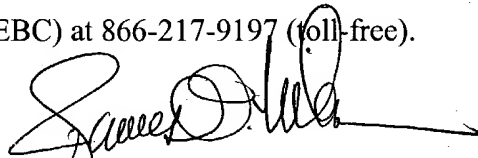
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Traviss C McIntosh whose telephone number is 571-272-0657. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James O. Wilson can be reached on 571-272-0661. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read "James O. Wilson", with a long horizontal flourish extending to the right.

James O. Wilson  
Supervisory Patent Examiner  
Art Unit 1623

Traviss C. McIntosh III  
May 24, 2004